

Macrophyte Diversity Alters Invertebrate Community and Fish Diet

Arnar Bjarnason^{1*}, Soffia Karen Magnúsdóttir²

Department of International Business, University of Akureyri, Reykjavík, Iceland^{1*}; Department of Marine and Aquatic Biology, Laxar Fiskeldi, Kópavogur, Iceland²

ABSTRACT

Iceland has for a long time been renowned for its rich fishing grounds and prolific fisheries sector. Salmon sea fish farming in Iceland, as we know it today, is however a relatively young industry which goes back only few years. It has however, already experienced strong growth in investment, production, exports revenue and is a provider of employment in rural areas in Iceland. Operating licences issued for salmon farming in sea cages in Iceland, amount in total to less than 60 thousand tons. The four biggest companies in the industry which control nearly all of the operating licences issued in Iceland, are majority owned or fully owned by Norwegian investors and existing companies in the Norwegian salmon industry. With one or two exceptions, for some reason, companies in the Icelandic fisheries and fish processing sector, do not participate as investors and shareholders in the build-up of the salmon sea fish farming industry in Iceland, and therefore, have not added salmon into their fish production.

Keywords: Salmon; Sea fish farming; Iceland; Act and Regulations; Environmental licence; Operating licence

INTRODUCTION

“Aquaculture production has been responsible for the increase in the global seafood supply since 1990” [1]. In recent decades, Salmon sea fish farming has been a significant contributor to meeting an ever increasing need by the world population for protein and has also been in the forefront in developing modern industrialized fish farming [2]. In Iceland, salmon sea fish farming is a relatively new industry, and its legal framework is still taking shape. The main objective of this paper is to give its readers an overview of the salmon sea fish farming in Iceland with an emphasis on: i) historical background of salmon fish farming in Iceland, ii) the process entrepreneurs have to follow to acquire a licence to establish a salmon fish farm in Iceland, iii) the current legal framework affecting the management of fish farming in Iceland, (iv) the current ownership structure of companies in the salmon fish farming industry in Iceland and finally, we put the industry into an international perspective by looking at its economic impact and conclude the paper with comments on the surprisingly limited involvement of companies in the Icelandic seafood sector in the salmon farming industry in Iceland.

The paper contributes to research, and to policy- and decision making in the salmon farming industry in Iceland. It provides business management researchers, with background information to underpin further studies of the salmon farming industry in

Iceland. For policy- and decision makers in the salmon farming industry the paper gives a comprehensive overview of the laws and regulations affecting/surrounding the salmon farming industry in Iceland and also provides them with insight into the economic impact that salmon farming has in an international context. It should be noted, that always when we refer to Act or regulations, we are referring to Icelandic laws and regulations.

BACKGROUND

Iceland has for a long time been renowned for its rich fishing grounds and prolific fisheries sector. Seawater salmon farming in Iceland, is however, a young industry and still very much in its infancy. In 1961 the Icelandic state established a salmon hatchery at Kollafjörður. Its main purpose was to produce salmon fry and smolt for release into rivers to increase angling catches as well as rearing to market size [3]. Until around 1970 only 10-15 small fish farm units operated in Iceland, mainly for salmon hatchery [4]. A significant growth in salmon farming in Iceland occurred in the second half of the 1980s. This was partly due to political policy and governmental incentives in the form of favourable loans. Most of this growth and incorporated investments was in on-shore salmon farms, where sea water was pumped into fishing tanks and mixed with warm geothermal water, to control environmental variables like salinity, temperature and light [5]. As a result of various factors such as: unfavourable market conditions in international

Correspondence to: Arnar Bjarnason, Faculty International Business, University of Akureyri, Suðurmýri 30, 170 Seltjarnarnesi, Iceland, Tel. +354-842-5000; E-mail: arnar@reykjavik-capital.is

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markets, unstable economic conditions in Iceland and even lack of know-how by the salmon farming companies, the very ambitious plans, initially set out by the salmon farming companies in Iceland, collapsed in the beginning of the 1990s with some fatal consequences for the industry.

Norwegian salmon eggs were first imported to Iceland in 1984 but in 1991 the company Stofnfiskur (www.stofnfiskur.is) was founded. Initially the main emphasis was on breeding and selection for ocean ranching of Atlantic salmon [6]. Icelandic stock, reared in Iceland showed good growth, but high grilse rate (maturity before market size was reached). In contrast, the Norwegian salmon stocks showed good growth potential and low grilse rate. Therefore, it was decided to import eyed ova from Norway to Iceland. This Norwegian ova is the origin of what now is known as the Saga Stock.

Salmon sea fish farming in Iceland, as we know it today, goes back only about 15 years when the companies Salar Islandica and AGVA ehf., started seawater salmon farming in Berufjordur and in Mjóifjordur, respectively. The second wave of salmon sea fish farming investments in the 21st century started about 10 years ago with the establishment of the current key companies in the industry: Arnarlax, Artic Sea Farm, Fiskeldi Austfjarða/Icefish Farm and Laxar fiskeldi.

Law and Regulations governing Salmon Farming

Salmon farming in Iceland is governed by the Ministry of Fisheries and Agriculture and the Ministry for the Environment and Natural Resources. The Icelandic Food and Veterinary Authority (IFVA) are responsible for the animal health and the issuing of operation licenses and the Environment Agency of Iceland for monitoring implementation of environmental licences. The two main legislations governing salmon farming in Iceland is “Act on fish farming” no. 71/2008 [7] and related regulations on fish farming no. 1170/2015 [8] and no. 283/2016 [9] and “Act on Health and Pollution Control” no. 7/1998 [10] and related regulation no. 941/2002 [11]. Furthermore, a significant political decision was made in the year 2004 with advertisement no. 460/2004 [12], made by the Minister of Agriculture, which defines certain coastal areas in Iceland as protected areas and prohibits the farming of salmon in sea cages within these regions. Other important acts and regulations governing fish farming in Iceland are: i) “Act on protection against fish diseases”, no 60/2006 [13] and related regulation no. 300/2018 [14] on protection against fish diseases and health monitoring of fish farms. ii) “Act on handling, processing and distribution of seafood products”, no. 55/1998 [15]. iii) Act and regulations regarding planning and environmental impacts affecting the salmon farming industry, stipulated in “Act on the organization of ocean and coastal areas”, no. 88/2018 [16] and the “Environmental Impact Assessments Act”, no. 106/2000 [17]. Furthermore, related regulations no. 660/2015 [18] and no. 713/2015 [19] about assessment of environmental impacts. iv) “Act on hygiene and pollution control”, no. 89/2018 [20] and finally, but not least, v) “Act about a Ruling Committee on Environment and Natural Resources”, no. 130/2011 [21] which in September 2018 revealed its importance when the Ruling Committee decided to withdraw previously issued operation licences issued by the IFVA to two of the biggest salmon farming companies in Iceland. In October 2018, the Icelandic Parliament made some amendments to “Act on fish farming” no. 71/2008 [22], allowing the Icelandic Minister of Fisheries, having previously received a review from IFVA, to grant a temporary operation license for a maximum of 10

months. During the tenure of the temporary operation license the respective fish farming companies are supposed to take appropriate measures to correct shortcomings in their initial operation license, as ruled by the Ruling Committee.

The Salmon Farming Licences Process

To establish a fish farm in Iceland, a developer/applicant needs a minimum two types of licenses: (1) an environmental licence and (2) an operating licence. As schematically illustrated in Figure 1, at the outset, a proposed salmon fish farming production must be announced and reported to The National Planning Agency (NPA). Salmon fish farming production in sea that is less 200 tons per year should, as previously stated, be reported to the NPA and fall into category C, but all salmon fish farming production exceeding 200 tons per year will fall into category B and are therefore, be a subject to the NPAs decision on whether environmental impact study is needed or not. There are then two possible routes of process, depending on whether there is a need for evaluation of environmental impact (EI) assessment or not (see Figure 2).

- i) Notification Process: Notification Process in the form of an announcement of the proposed project on the basis of Article 6. Act no.106/2000 [23] and paragraph 1.1. of Annex 2 in the same Act and regulation no. 660/2015 [24] on environmental impact assessment. In case of the Notification Process, the developer sends a special “Implementation notification” and an accompanying report. The report, describes the geographical area, the anticipated process and other important aspects of the operation. After receiving the report and data from the developer, the NPA, checks the data and may request further information. When the report and data have been validated by the NPA, the report is sent to a number of referees for further

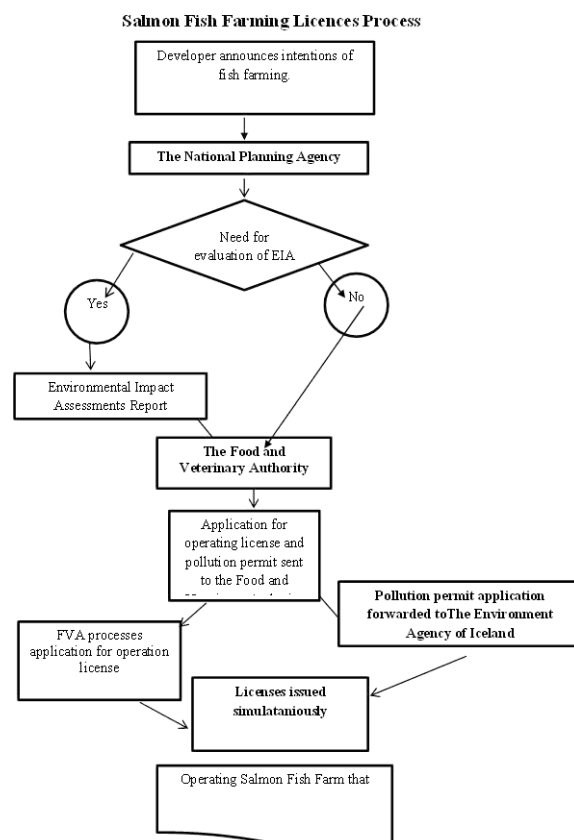


Figure 1: Salmon Fish Farming Licences Process.

review and comment. If the NPA and its referred reviewers have additional comments, the developer takes some remedial measures in response to those comments. When experts at the NPA have received sufficient data and information, they make a decision regarding the proposed project, i.e. whether the project should be a subject to an Environmental Impact (EI) assessment or not. NPAs decision is published in the media and on the website of the NPA. NPAs decision can be appealed. If NPAs decision is “NO” the developer can go ahead and apply for an operating license by the IFVA and a pollution permit from the Environmental Agency, but if NPA’s decision is “YES” the project will have to follow the “Evaluation Process”.

- ii) Evaluation Process, where the developer/applicant submits an evaluation strategy report, without prior notice or was required to do so following a “YES” decision by the NPA. There are many steps towards the NPAs decision.

First The developer submits a draft of the “evaluation strategy proposal”, were the procedure, geographical area and all operational aspects are explained. The draft is then reviewed by the NPA and after it has met their requirements, the NPA makes a public announcement thereof and post the “draft evaluation strategy proposal” on the NPA’s website. Second After the “draft evaluation strategy proposal” has been published and comments received by the NPA the “Evaluation Strategy Proposal” is subsequently published in the media and on the NPAs website. Furthermore, the “evaluation strategy proposal” is sent out to other appropriate authorities for their comments and remarks, such as the Marine and Freshwater Research Institute, the IFVA and the Environmental Agency.

Third The developer submits “A Pre-Assessment Report” and the NPA verifies that the report is in line with the “Evaluation Strategy Proposal” and according to existing law and regulation. If that proves to be the case, the NPA will publish a notification in the media and releases the “Pre-Assessment Report” on its website, for the general public to comment. Furthermore, the NPA refers the

“Pre-Assessment Report” to other institutions, like the Marine and Freshwater Research Institute, for comments.

Fourth Following the “presentation” period, the developer gets all comments and annotations from the NPA. In the subsequent “Assessment Report” the developer has to address all the comments and issues identified by the NPA and other parties and give a comprehensive assessment of the environmental effects of the planned operation.

Fifth The process ends by the NPAs opinion of the operation’s environmental impacts.

According to law no. 130/2011 [25] about Ruling Committee on Environment and Natural Resources, all those who have legitimate interest, can appeal the decisions previously made by the NPA and IFVA, involving the granting of environmental- and operating licences. Therefore, environmental- and operating licences, which have already been issued, can be withdrawn at the discretion of the respective Ruling Committee on Environment and Natural Resources.

Operating Licences and Ownership Structure

According to information on IFVA’s website (www.mast.is) in October 2018, operating licences issued for salmon farming in sea cages in Iceland, amount in total just under 60 thousand tons. The four biggest companies in the industry: Arnarlax, Artic Sea Farm, Fiskeldi Austfjarða/Icefish Farm and Laxar fiskeldi, control nearly all of the issued operating licences, but about 15% (8.800 tonnes) of the issued operating licences are issued for the farming of sterile (tripolite) salmon only.

All of the four above listed companies are majority owned or fully owned by companies in the Norwegian salmon industry or other Norwegian investors. Only two of these companies generated revenues from products sold in the year 2017, which indicates the infancy of this industry in Iceland. The total operating income of the respective companies, in the year 2017, was equivalent to ISK 9.6 billion and total operating cost, equivalent to ISK 8.8 billion.

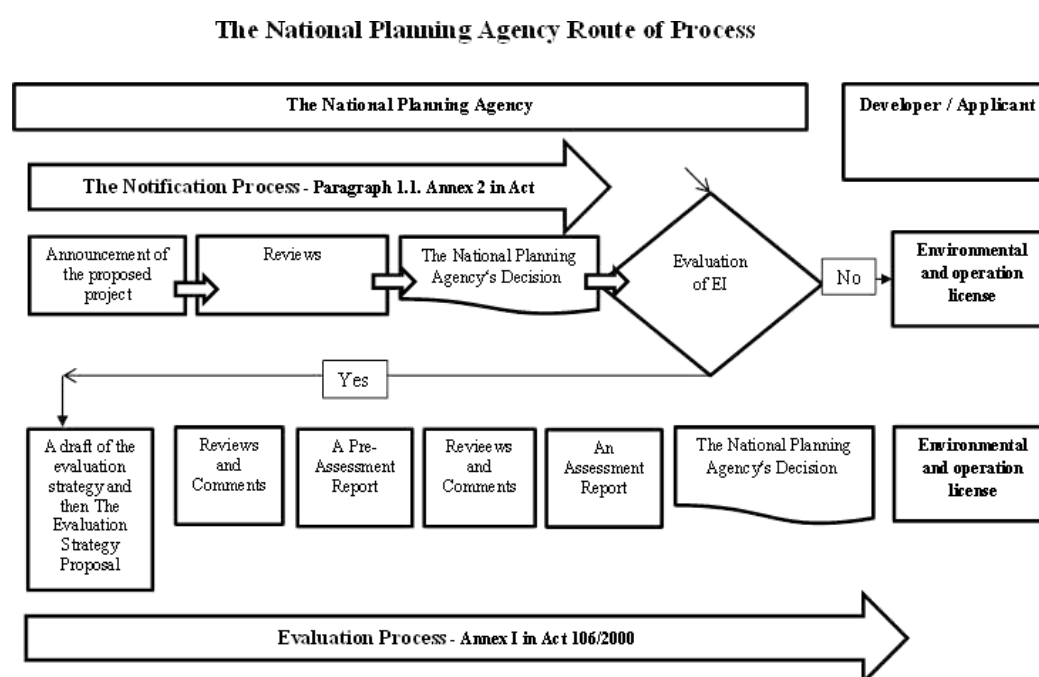


Figure 2: National Planning Agency Route of Process.

Table 1: Data of FAO-Fisheries and Aquaculture Information and Statistics Branch from OECD.

Atlantic Salmon Production (tonn)								
	2009	2010	2011	2012	2013	2014	2015	2016
Australia	29,893	31,807	36,662	43,982	42,825	41,591	48,331	56,115
Iceland	714	1,068	1,083	2,923	3,018	3,965	3,260	8,420
Ireland	12,210	15,691	12,196	12,440	9,125	9,368	13,116	16,300
Faroe Islands	51,383	45,391	60,473	76,564	75,821	86,454	80,600	83,300
Norway	862,908	939,536	1,064,868	1,232,095	1,168,324	1,258,356	1,303,346	1,233,619
UK (Scotland)	144,654	154,625	158,305	162,543	163,512	179,391	172,137	163,132
US	14,074	19,535	18,595	19,295	18,866	18,719	18,719	16,185
Chile	233,308	123,233	264,349	399,678	492,329	644,459	608,546	532,225
Canada	100,212	101,544	110,328	116,101	97,629	86,347	121,926	123,522
Russia	2,126	4,500	8,500	8,754	22,500	18,675	10,834	13,323
Total	1,451,482	1,436,930	1,735,359	2,074,375	2,093,949	2,347,325	2,380,815	2,246,141
Source:	FAO - Fisheries and Aquaculture Information and Statistics Branch - 24/09/2018							
Data extracted on th 24 Sept 2018 16:02 UTC (GMT) from OECD.Stat								

Salmon Farming Production and Economic Impact in an International Perspective

As stated above, the total licences for seawater based salmon fish farming production in Iceland, amount to close to 60 thousand tons, which is very small compared to the total world production of farmed salmon. In 2016, total global production of farmed salmon was around 2.3 million tons, of a total value close to 14.5 billion US dollars [26]. Norway is by far the leading producer of farmed Atlantic salmon, with about 55% of the total world production. The second biggest producer is Chile with around 23.5% and followed by the UK (Scotland) close to 8%, Canada around 5.5% and the Faroe Islands with just over 3.5%. Iceland's share in the total production of Atlantic salmon was in the year 2016 was less than 0.4% of the total world production. The impact of salmon farming on the labour market in the respective countries is significant. In Norway around 7.270 jobs were registered in hatchery and salmon production in the year 2016. In Scotland, the respective number in 2016 was around 1.780 [28] and in the Faroe Islands around 1.070 jobs [29]. According to information on the website of the Icelandic Association of Aquaculture (<http://www.lf.is>) it is estimated that the aquaculture sector in Iceland, as a whole, provides about 500 full time jobs.

CONCLUSION

The Icelandic salmon sea fish farming industry has experienced a strong growth in investment, production, exports revenue and as a provider of employment in rural areas in Iceland over the last few years. This growth in salmon farming seems to be largely due to an initiatives taken by Icelandic entrepreneurs, who in the aftermath of the financial collapse in Iceland in the Autumn of 2008 and the consequent weakening of the Icelandic krona, saw the chance to exploit an opportunity which might exist in the build-up of profitable salmon sea-farming industry outside the coastlines in Austfjords and Vestfjords, in Iceland. The significant and steady increase in world salmon prices experienced at that time was also inevitably a contributing factor to the initiative taken by the entrepreneurs. In most cases, it seems that the individual Icelandic entrepreneurs had already acquired: experience, education and know-how, in salmon farming abroad, often in Norway. Through partnership in the form of shareholding companies, these

companies have managed to acquire nearly all of the operating licences so-far issued, for salmon sea fish farming in Iceland. It's also noteworthy that none of companies in the Icelandic fisheries and fish processing sector are major shareholders in the salmon sea fish farming industry in Iceland. For some reason, these companies seem to have overlooked the opportunity that might exist for them to broaden their source of fish supply by investing in the Icelandic salmon sea fish farming industry. It is an interesting puzzle as to why salmon sea fish farming has been so slow to develop in Iceland compared to some of Iceland's neighbours including Norway, Scotland and Faroe Islands. We have not attempted to answer that question here. However, it may have to do with the licence and environmental planning process or it may be due to negative historical experience with on-shore salmon farming in Iceland in the 1990s. A comparative examination of the Icelandic licencing and environmental planning process with that in Norway and Scotland may provide insights.

CONTRIBUTORS

Dr. Arnar Bjarnason, is a lecturer in International Business at the University of Akureyri and CEO and principal owner of Reykjavik Capital ehf. (www.rc.is) <https://orcid.org/0000-0002-5000-4988>.

Soffia Karen Magnúsdóttir, has an M.Sc. in biology and B.Sc. in marine and aquatic biology. She works as an expert for Laxar fiskeldi ehf. (Salmon fish farming ehf.) in Iceland.

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